

Claims

1. An image display device which comprises an image display panel, in which two or more groups of particles having different colors and different charge characteristics are sealed between opposed two substrates, at least one of two substrates being transparent, and, in which the particles, to which an electrostatic field produced by a pair of electrodes provided on one substrate or both substrates respectively is applied, are made to move so as to display an image, characterized in that a chip for transmitting a drive signal to the image display panel is arranged in the substrate.

2. An image display device which comprises an image display panel, in which the liquid powders, which indicate a high fluidity in an aerosol state such that solid-like substances are suspended in a gas stably as dispersoid, are sealed between opposed two substrates, at least one of two substrates being transparent, and, in which the liquid powders, to which an electrostatic field produced by a pair of electrodes provided on one substrate or both substrates respectively is applied, are made to move so as to display an image, characterized in that a chip for transmitting a drive signal to the image display panel is arranged in the substrate.

3. An image display device which comprises an image display panel, in which two or more groups of particles having different colors and different charge characteristics are sealed between opposed two substrates, at least one of two substrates being transparent, and, in which the particles, to which an electrostatic field produced by a pair of electrodes provided on both substrates respectively is applied, are made to move so as to display an image, characterized in that the two substrates are constructed by a transparent substrate and the pair of electrodes are constructed by a transparent electrode.

4. The image display device according to claim 3, wherein colors of the particles are white color and black color, and a monochrome display is performed on both surfaces of the image display panel.

5. The image display device according to claim 3, wherein colors of the particles are white color and black color, and a color filter is provided on one of the substrates, so that a monochrome display is performed on one surface of the image display panel and a color display is performed on the other surface of the image display panel, to which the color filter is provided.

6. The image display device according to claim 3, wherein color combinations of the particles in three image display elements, which construct one pixel of the image, are black color and red color; black color and green color; and black color and blue color; respectively, so that a color display is performed on both surfaces of the image display panel.

7. An image display device which comprises an image display panel, in which the liquid powders, which indicate a high fluidity in an aerosol state such that solid-like substances are suspended in a gas stably as dispersoid, are sealed between opposed two substrates, at least one of two substrates being transparent, and, in which the liquid powders, to which an electrostatic field produced by a pair of electrodes provided on both substrates respectively is applied, are made to move so as to display an image, characterized in that the two substrates are constructed by a transparent substrate and the pair of electrodes are constructed by a transparent electrode.

8. The image display device according to claim 7, wherein colors of the liquid powders are white color and black color, and a monochrome display is performed on both surfaces of the image display panel.

9. The image display device according to claim 7, wherein colors of the liquid powders are white color and black color, and a color filter is provided on one of the substrates, so that a monochrome display is performed on one surface of the image display panel and a color display is performed on the other surface of the image display panel, to which the color filter is provided.

10. The image display device according to claim 7, wherein

color combinations of the liquid powders in three image display elements, which construct one pixel of the image, are black color and red color; black color and green color; and black color and blue color; respectively, so that a color display is performed on both surfaces of the image display panel.

11. The image display device according to one of claims 1 and 3 - 6, wherein an average particle diameter of the particles is 0.1 - 50 μm .

12. The image display device according to one of claims 1, 3 - 6, and 11, wherein the difference of a surface charge density in an absolute value between two groups of the particles measured by using the same kind of carrier in accordance with a blow-off method is 5 - 150 $\mu\text{C}/\text{m}^2$.

13. The image display device according to one of claims 1, 3 - 6, 11 and 12, wherein the particles are particles in which the maximum surface potential, in the case that the surface of particles is charged by a generation of Corona discharge caused by applying a voltage of 8 KV to a Corona discharge device deployed at a distance of 1 mm from the surface of the particles, is greater than 300 V at 0.3 second after the Corona discharge.

14. The image display device according to one of claims 2 and 7 - 10, wherein an apparent volume in a maximum floating state of the liquid powders is two times or more than that in none floating state.

15. The image display device according to one of claims 2, 7 - 10, and 14, wherein a time change of the apparent volume of the liquid powders satisfies the following formula:

$$V_{10}/V_5 > 0.8;$$

here, V_5 indicates the apparent volume (cm^3) of the liquid powders after 5 minutes from the maximum floating state; and V_{10} indicates the apparent volume (cm^3) of the liquid powders after 10 minutes from the maximum floating state.

16. The image display device according to one of claims 2, 7 - 10, 14 and 15, wherein an average particle diameter $d(0.5)$ of the liquid powders is 0.1 - 20 μm .